

and of which I have more to say anon, there is at least as much to drain downwards as there was to drain upwards in the first place; and still the question remains for discussion, whether the poisonous carbonic acid and its diluents expelled from the lungs in a walled and ceiled or roofed apartment, of whatever form, or under whatever possible arrangement for mere facilitation of exit, at least without the aid of additional heat, be not liable immediately to re-enter that apartment, together with the surrounding or adjoining fresher air, even after it has been poured into it.

It is all very well to enlarge upon the "exquisite adjustments" of nature in carrying off carbonic acid direct and buoyant from human lungs, and through the circumambient air, "away to the green woods," and "out of our way;" but "E. L. G." forgets that we are not here engaged in considering the exquisite adjustments of nature at all, but his own adjustments, which, however superior, so far as they go, to ordinary human adjustments, are not quite so exquisite as nature's.

I admit that such means as those suggested by me for completely preventing the "cooling" carbonic acid, as I have called it, or the "cooled" foul air, as I shall show that "E. L. G." has himself called it, from issuing out of the reservoir above the ceiling, where he admits it "rests," and is already "cooled," and into the open air, contaminating, or, as I have said, *polluting*, that air—of course by mixing or diffusing itself so far even then with it as it is about to enter the building or apartment whence the foulness had just issued, constitute what "E. L. G." even in speaking of his own outlets, calls a "refinement,"—a theoretical refinement I would even call it; and in truth, when "E. L. G.'s" proposed internal adjustment for upward drainage shall have been practically and generally brought into use, we may have comparatively little to complain of in the way of want of ventilation; but assuredly it is not only allowable but desirable to look to even the theoretical perfection of such a system of ventilation (if I may still safely so call it) as that suggested by "E. L. G.;" and it still, I maintain, remains at least a question, even on his own admitted principles, as I shall now endeavour to show, whether or not the foul air got rid of so far by his upward drainage and outward vents, be not then peculiarly apt immediately to re-enter the apartment whence it was just expelled, unless it be entirely and finally got rid of by subsequent downward drainage, or by fire or heat, in chimneys, as, in other cases, he himself intends.

But, first of all, allow me to observe that "E. L. G." has a much more implicit faith in the certainly truthful, but still immature doctrine of the mutual diffusion of the gases, in this case, than I have. His assumption, by the way, of my ignorance of the existence of this law is not only totally groundless in anything I have said, but erroneous in fact. Indeed, had I really been ignorant of its existence down to so recent a date as 25th September last, when an article on "Smoke Consumption" appeared in your columns, I had then and there an opportunity of being warned of what, however, was really my own *precious* opinion, that implicit confidence or reliance ought not to be placed in the unregulated operation of this law, under circumstances analogous to those now under discussion.

Of the law itself "E. L. G." speaks as if it were a recent discovery by Faraday; but, still under investigation as it is, this is quite a mistake, as it also is to attribute to him the particular experiment referred to, which was, originally at least, one of Dalton's, and in which the carbonic acid and the hydrogen, instead of becoming mutually diffused in so magical a manner as "E. L. G." would have us believe, are said to have taken "a few hours" to do so; so that even though Faraday found these gases under such circumstances to mix with greater rapidity, we have here a discrepancy which only justifies us the more in hesitating to place implicit confidence in the general announcement of this law, under circumstances such as those now under consideration. But even though two such

gases as hydrogen and carbonic acid be capable of mutual diffusion in "a few seconds," it does not follow that common air and carbonic acid are so. Professor Graham has found that "the lighter the gas the more rapidly does it diffuse itself." Thus hydrogen diffuses itself with five times the rapidity of carbonic acid." Why, then, pretend to give the ignorant "D." the advantage of such an instance, above all others, of the rapidity of diffusion? Why not have adduced the rate of diffusion between carbonic acid and common air itself? It would have been much more to the purpose to have done so, but would not have enforced "E. L. G.'s" own position so well: that is the fact.

The gases, according to the competent authority here named, just diffuse themselves according to the very same law by which we see vapours and volatile bodies diffuse themselves in the air—the lighter all the more rapidly, the heavier all the more slowly. Here we have a much more apt and appreciable visible illustration of this law than in "E. L. G.'s" rather far-fetched illustrations in oil. Carbonic acid, except at the moment it issues from the mouth, will diffuse itself much more like a heavy vapour than a light gas, whatever it may do under the free, unobstructed, and exquisite balancements and arrangements of nature, which "E. L. G." admits that even his own upward drainage has already overthrown, as I shall now proceed to show.

The attention and anxiety of "E. L. G." appear, in fact, to have been exclusively confined, in the development of his view of the ventilation of foul air, to "a ceiling so formed as to let it through without hindrance, and yet prevent its return, when cooled," by the vents through which it had just been let; so that "this part of every building (ought) to be contrived according to whatever our latest science may prove necessary to the free passage of light fluid through it from below, and its retention above when once through." So far from stating in his view that the foul air continues to possess the warmth requisite to enable it still, when it shall have reached the outward air, to rise by its own levity, and so mix freely with the air "out of our way," "E. L. G." warns us that the ceiling vents should not be too large, so "that the foul air spread out in the space above the ceiling, and COOLED so as to fall back and rest on the ceiling, may have as little as possible of its base unsupported and ready to fall back through the vents should an interruption of their flow allow it;" for, moreover, as he tells us, "the foul air loses all its upward tendency before many seconds, so that it must not be played with;" and "farther," that "there is even an advantage in the foul air cooling and sinking a little after flowing out of the ceiling vents, as this ensures its not re-entering them."

To what purpose, then, but to lead both himself and others into error, does "E. L. G." now attempt to disprove the advantage or necessity of "downward drainage" from the "cooled" deposits above his ceilings, by inconsistent talk about "mixture with the surrounding air, which must, before it has cooled, have irrecoverably diffused it?"

So "cooled" does "E. L. G." conceive the foul air resting above the ceiling, as in a reservoir, to be, that he impressively points out that it must be *driven out*, as it were, *from behind*, by the active or still warm air as it rises through the ceiling vents. How, then, can this "cooled," or, as I less "loosely" called it, "cooling" air have still all that buoyancy which it has as it issues from the mouth, but which is "only just adequate" even then, as "E. L. G." himself reminds us, to enable it to rise directly and immediately in the air and diffuse itself out of our way? Will it not, on the contrary (and all the more quietly to leeward), "pollute," as I said, the fresh air adjoining, and just about to enter, the building or apartment whence it has just been expelled by force applied "behind"?[†] Moreover, how

* And note—this diffusion is not merely upwards, but in every direction, downwards inclusive, as "E. L. G." himself indeed admits.

† If "the whole power by which self-ventilation is kept going must be derived from the current through the cel-

could it "pollute" that air, and not mix or diffuse itself in it? It seems to me that it required no such *recherche* knowledge of "the law of the mutual diffusion of gases" as "E. L. G." brings to bear upon this simple circumstance, to enable any one to know very well that the cooling carbonic acid and its diluents, pushed out into the air adjoining a house and polluting it as it is about to enter that house, must necessarily "diffuse" itself throughout that air, and have the air "mutually" diffused in it. How, then, did he come to assume my ignorance even of the fact of such mutual diffusion, at the very moment I was speaking of the fresh air being so polluted?

I had more of "E. L. G.'s" errors, both of commission and of omission, to deal with, but I fear that I have already exceeded the space you will allot me. I cannot conclude, however, without drawing particular attention to Ericson's alleged discovery of the extraordinary rapidity with which gases or vapours may be either deprived of heat or loaded with it. The law of the mutual diffusion of gases itself cannot be correctly and finally investigated and established without the closest consideration of this discovery, if it really be one; and it is reported that Ericson has not only had an enormous engine and ship constructed on the faith of it, but that he has already had such an engine successfully at work by means of it for many months past. Moreover, the alleged discovery is of marked importance in the consideration of the very subject under notice, namely, the final disposal of the foul air expired from the lungs. J. E. D.

EDUCATION IN ART.

ON the 24th inst. Mr. Henry Cole, as General Superintendent of the Department of Practical Art, delivered an introductory lecture at Marlborough House "On the Facilities afforded by the Department to all Classes of the Community in obtaining Education in Art."

The School of Design, out of which this department has grown, said Mr. Cole (after some introductory observations), was founded in 1837. During an existence of fourteen years, some twenty branch schools in many of the most important seats of manufacturing industry have been established. The School of Design had been founded expressly with the commercial object of improving the patterns of manufactures. It sought to do this by affording education in art, especially to artisans, and to artisans only. From time to time attempts had been made, in various ways, to limit the education to that class of the community; but these attempts thus to circumscribe the action of the schools, arising upon a mistaken and imperfect view of the work to be done, did not succeed. Private classes, or classes consisting of students probably not artisans or designers, were noticed by Mr. Poynter, the late Inspector of the Schools of Design, in his last reports, as existing at Leeds;—at Manchester, where the admission of artists was stated to be "calculated to extend the influence of the school, and to identify it with the arts in general in the public estimation;"—at Newcastle;—at Norwich, "the Grammar-school Class;"—at Nottingham;—at Sheffield, "private classes beneficial to the school by increasing the number of its supporters;"—at Glasgow, "a life class, principally attended by artists," which "tended to raise the importance of the schools;"—at Dublin, "where there was a considerable attendance of female students qualifying themselves as governesses with the purpose of going to America;"—at Belfast;—and at Cork, where there was a small private male class, three students being from Queen's College. These facts proved a desire on the part of the community generally to participate in the advantages of the schools, and that the limitation was wrong and ineffective.

ing vents," and it be "at the ceiling alone that any air is pressing to pass through from one space into another," so that "this current must precede and cause all the others, must be the sole motive power, both to draw in behind it fresh air through the inlets near the floor, and to drive out before it the foul air that has already got above the ceiling," as "E. L. G." so forcibly describes it, what does he mean by "the supply of fresh air coming necessarily from windward?" If it be drawn in by a power in the interior, it will come from leeward just as much as from windward.